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P CYGNI IN 1987–1993

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P Cygni is a B1 Ia^+ hypergiant in the Cyg OB1 association. It is one of the oldest known variable stars, in fact second only after Mira Ceti. It was discovered during an S Dor-type outburst in 1600. The star spent the following decades showing violent behaviour, but reached a quiet state by around 1700 which is still in effect today (de Groot 1986).

P Cygni has been considered to be without any appreciable variation for a long time. Consequently, it was observed unfrequently (a good listing of early observations is given by Müller & Hartwig 1920), the first systematic photoelectric observations began only in the late 1930's in Abastumani. The Abastumani observers later classified P Cygni as a W UMa-type eclipsing binary (Kharadze & Magalashvili 1967), though further observations did not confirm it (Alexander & Wallerstein 1967).

Percy was the first to start a long-term campaign of P Cygni observations (Percy & Welch 1983, Percy et al. 1988, 1996). His results showed that the star varied irregularly on time-scales from a few days to a few months, while the colour variations were smaller and apparently independent of the V light curve.

Here I present observations of the star made with the 50-cm telescope of Konkoly Observatory in Piszkéstető (1987–88) and with the 60-cm telescope in Budapest (1991–93). The observing circumstances were the same as mentioned in previous papers (Zsoldos 1993, 1995). I used 36 Cygni as comparison star ($V = 5.58$, $B-V = 0.06$, $U-B = 0.00$). The observations are given in Table 1 and Fig. 1.

The small number of observations precludes the possibility of a thorough period analysis. One can, however, confirm the conclusions of Percy et al. (1988): the time-scales vary between 20 and 200 days. The most probable cycle lengths in the given data set are $P_1 = 26\overset{d}{.}7$ and $P_2 = 218\overset{d}{.}8$. These values remain the same if we include further observations of Markova & Tomov (1998).

The colour variations are on a smaller scale than the light variation, also confirming earlier results. It seems from Fig. 1, that, at least in the case of the longer cycle, the light and colour curves are antiparallel. This is what one would expect from non-radial pulsations (supposing that the cause of the variation is pulsation). The long cycle lengths (between 20^d and 200^d) also favour non-radial pulsation (Lovy et al. 1984).

Israelian et al. (1996) discussed the possible — if any — connection between the shell ejections observed in P Cygni and the light variations. They seem to have found some indication that shell ejections were followed by an increase in visual brightness.

Table 1: Photometry of P Cygni

J.D.	V	$B-V$	$U-B$
2446925.571	4.821	0.379	−0.707
6966.475	4.787	0.394	−0.712
6983.467	4.851	0.389	−0.695
6984.465	4.842	0.382	−0.697
6985.389	4.823	0.387	−0.689
6997.452	4.793	0.393	−0.692
7016.362	4.812	0.389	−0.707
7018.445	4.825	0.390	−0.707
7019.387	4.824	0.391	−0.697
7030.385	4.818	0.399	−0.696
7032.377	4.847	0.401	−0.712
7060.316	4.827	0.391	−0.682
7062.329	4.847	0.401	−0.694
7098.241	4.875	0.375	−0.696
7335.490	4.740	0.413	−0.626
7349.454	4.789	0.405	−0.624
7372.442	4.780	0.410	−0.612
7374.397	4.801	0.417	−0.611
7406.356	4.754	0.405	−0.647
7408.365	4.774	0.403	−0.635
7433.281	4.831	0.395	−0.639
7446.299	4.872	0.402	−0.619
8410.492	4.819	0.402	−0.634
8417.528	4.844	0.394	−0.608
8433.528	4.836	0.383	−0.606
8475.518	4.782	0.406	−0.674
8477.521	4.793	0.390	−0.655
8485.441	4.800	0.396	−0.686
8534.310	4.824	0.377	−0.682
8557.281	4.876	0.371	−0.654
8573.269	4.846	0.375	−0.673
8813.504	4.838	0.382	−0.697
8853.410	4.822	0.395	−0.678
8859.349	4.857	0.380	−0.682
8897.314	4.755	0.416	−0.684
8936.242	4.829	0.388	−0.707
2449254.346	4.801	0.392	−0.686

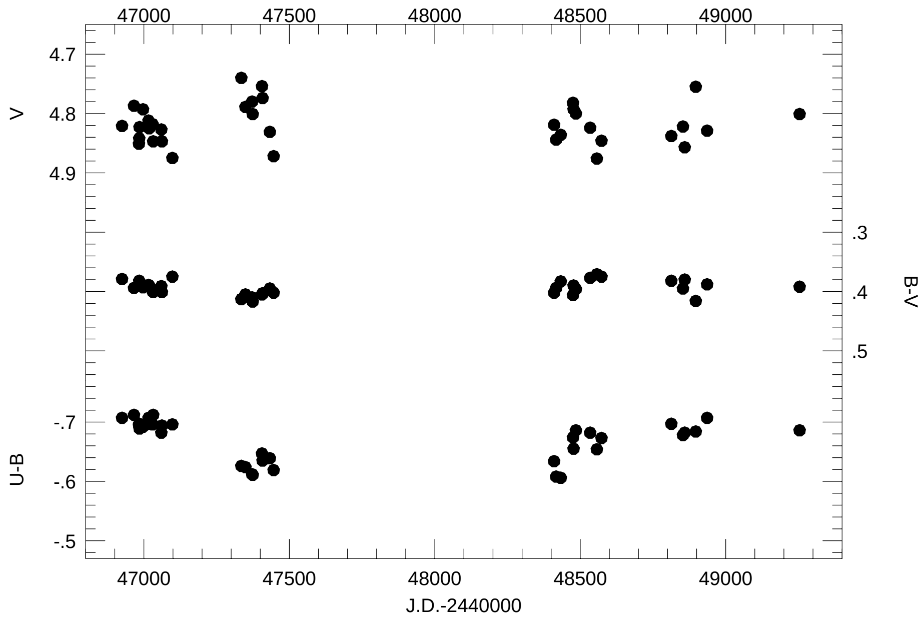

Figure 1. The light and colour curves of P Cygni.

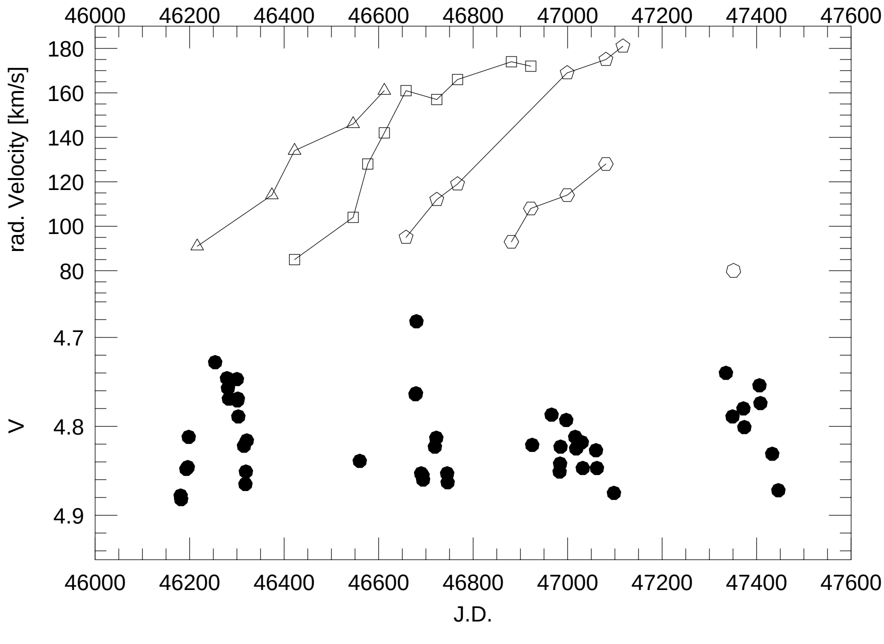

Figure 2. The connection of light curve and shell ejections. The lower part is the light curve, the upper part is the velocity variations of Fe II lines.

Since my observations cover a longer time, it seems worth comparing the light curve with the radial velocities of the various shells. Figure 2 shows the light curve (my observations from Percy at al. (1988) and from Table 1 of the present paper) and the radial velocity variations of the absorption components of FeII lines from Table V of Israelian et al. (1996).

Figure 2 shows the possibility of the connection. The ejection of a shell roughly coincides with the ascending branch of a wave on the light curve. The characteristic time scales also support this connection: they are about 200 days for the ejections, 219 days for the light curve, respectively. It must be noted here, however, that Stahl et al. (1994) did not find any correlation between radial velocity and light curve.

It is clear that there is still a need for more photometry of P Cygni. A longer, continuous light curve would help to decide if the connection shown in Fig. 2 is real or coincidental.

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Correction [Wed Feb 19 11:06:50 MET 2003]
The correct reference is:
Kharadse, E. K., Magalashvili, N. L., 1967, *The Observatory*, **87**, 295